working with the Otto cycle, he was of opinion, that, with engines of large size, the results would be still better if the cycle were altered, especially when generator-gas was used. His reasons for this were fully stated in the paper.

The following was a summary of the points urged by the author:—

1.—When town-gas was used for driving the engines of an electrical station, the consumption was about 50 per cent. less than the volume of gas required to give the same amount of light by ordinary burners.

2.—When town-gas was used, neither boiler nor firemen were required, and there were no ashes to remove; less space was needed; no accumulators were required, except such as might be necessary to equalize the load of the engines and to provide for a small amount of storage. The engines could be worked in the most crowded districts, close to where the lights were required, and where boilers were not allowed.

3.—When generator-gas was used, the consumption of fuel under a full load would be at least 50 per cent. less than with steam-power, and the loss due to steam-boilers not being fully worked could be almost entirely avoided.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—We regret to hear that Professor Cayley has been suffering from serious illness, and that he is in consequence unable to give this term his advertised course of lectures in Pure Mathematics.

L. Cobbett, M.A., M.B., of Trinity College, has been appointed Demonstrator of Pathology in the place of Dr. E. Lloyd Jones, who has resigned the office.

Mr. F. Darwin, Deputy Professor of Botany, announces a special course of lectures in the Chemical Physiology of Plants, to be given by Mr. Acton, of St. John's College, on Tuesdays in the present Lent Term.

Mr. J. Y. Buchanan, F.R.S., announces a second course of lectures in Geography, to be given in the Easter Term.

Mr. A. E. Shipley has been appointed an additional member of the Special Board for Biology and Geology.

SCIENTIFIC SERIALS.

Journal of the Royal Agricultural Society of England, 3rd series, vol. iii. pt. 4.—Cottage sanitation (illustrated), by H. McLean Wilson, a paper prepared under the supervision of Dr. Spottiswoode Cameron and T. Pridgin Teale, F.R.S. It contains a discussion of the principal sanitary defects, which are most likely to be found in the houses of agricultural labourers, with valuable suggestions and remedies. The object aimed at is "to put the whole country, and every house in the country, into such a condition that if the epidemic (cholera) should break out it would have no chance of spreading."—Field experiments on the fixation of free nitrogen, by James Mason, gives an account of the enriching of some plots of poor land on the Oxford clay at Eynsham by the growth of two leguminous crops in succession. The two crops chosen were beans and mixed clovers. So far as they go the results are striking. Prior to 1888 the land had never been cultivated or received any manure. Brought into tillage in that year two plots produced 10½ cwts. and 9 cwts. per acre of barley and oats respectively, straw included,—an excessively low return. In the autumn of 1888 the plots were treated with 20 cwts. of basic slag per acre, and the subsoil with the same amount. Beans in the following year yielded an average of 46 bushels and 23 cwts. straw per acre. In 1890 mixed clovers gave a yield of 28 cwts. per acre as the average of the two plots, and in 1891 a crop of three tons clover-hay was obtained. Potatoes were grown upon the plots last year, and gave an average yield of eight tons per acre. Excepting the basic slag, no manure of any kind had ever been applied to the plots. The experiments are being continued and extended.—Wild birds, useful and injurious (illustrated), by C. F. Archibald.—Utilization of straw as food for stock, by Joseph Darby. Showing methods of using chaffed straw as a remedy for the deficient hay crop of last summer, with records of previous experiences under similar circumstances.—Yew poisoning, by Mr. E. P. Squarey, Mr. Charles Whitehead, Mr. W. Carruthers, F.R.S., and Dr. Munro. But few definite conclusions can be arrived at, owing to the conflicting nature of the information available. It appears, however, (1) that both the male and female yews are poisonous; (2) the poisonous alkaloid (or alkaloids) exists chiefly in the leaves and in the seeds; (3) the fleshy part of the fruit is harmless, or nearly so; (4) the amount of poisonous alkaloid in the leaves varies considerably with individual trees, and perhaps with the season of the year. Dr. Munro contributes a review of the chemical work done upon taxine, the only alkaloid in yew which has been investigated; very little is known with certainty about it, either as to its chemical nature or its physiological action. As Dr. Munro suggests, "yew leaves merit *exhaustive* chemical examination."—Besides the official reports, there are several short articles, including one upon the ferments of milk, abridged by Dr. Munro from Prof. H. W. Conn's pamphlet on the subject, issued last summer; also a paper upon the decline of wheat-growing in England, by the editor.

American Journal of Science, January.—The age of the earth, by Clarence King. This paper contains an application of Lord Kelvin's reasoning from probable rates of refrigeration to the determination of the earth's age, aided by Dr. Carl Barus's recent work in geological physics, especially his determination of the latent heat of fusion, specific heats melted and solid, and the volume expansion between the melted and solid state, of the rock diabase. Thermal considerations have shown that with a given initial excess of temperature of the earth over surrounding space, and an assigned value for rock conductivity, it is possible to determine the curve of temperature from the earth's centre to its surface. It appears that for an initial temperature of 2000° C., the initial maximum temperature must still extend uniformly from the centre to within a few hundred miles of the surface for any admissible value of the age. But since the pressures increase steadily as we proceed towards the centre, there must be a point at which their effect outweighs that of the temperature, and the material, though very hot, remains in the solid state. Now on the data supplied by Barus's researches it is possible to state what temperatures are necessary to keep a certain representative species of rock in the fluid state at successive points within the earth. The amount of possible liquid layer is limited by the facts of tidal rigidity, which fix the maximum admissible temperature at 1950° and the age at 24×10^6 years. Lower values are excluded by the gradient of temperature observed on proceeding downwards from the surface. This value, twenty-four million years, agrees fairly well with the age assigned by Helmholtz and Kelvin to the sun. It is also concluded that the earth never was all liquid, that the original liquid layer did not exceed 53 miles, and that the spheroidal shape is due to the plasticity of the lithosphere as manifested under the action of very slowly applied forces.—Tertiary geology of Calvert Cliffs, Maryland, by Gilbert D. Harris.—"Anglesite" associated with boleite, by F. A. Genth.—Preliminary account of the iced-bar base apparatus of the United States Coast and Geodetic Survey, by R. S. Woodward.—Some experiments with an artificial geyser, by J. C. Graham.—Observations of the Andromed meteors of November 23 and 27, 1892, by H. A. Newton.—Preliminary notice of a meteoric stone seen to fall at Bath, South Dakota, by A. E. Foote.—New Cretaceous bird allied to Hesperornis, by O. C. Marsh.—Skull and brain of Claosaurus, by O. C. Marsh.

THE *Botanical Gazette* for October contains an interesting article by Mr. H. L. Russell on the bacterial investigation of the sea and its floor. The author has had the opportunity of carrying on bacteriological observations in sea-water, both from the Bay of Naples and from the coast of Massachusetts. He finds micro-organisms invariably present in sea water, though not in such large numbers as in fresh water, even at a great distance from the shore, and to a depth of 3200 feet; and a larger number in the slime at the bottom than in the water itself. Some marine forms are cosmopolitan, and the bacteria that are so universally present in sea-water and mud seem to be quite peculiar to this habitat.—Mr. E. L. Berthoud describes the mode in which the geographical distribution of some plants has been greatly extended by the agency of the buffalo.—In the number for November Prof. Underwood gives a report of the proceedings of the International Botanical Congress lately held at Genoa.—Mr. G. W. Martin contributes an account of the development of the flower and embryo-sac in *Solidago* and *Aster*.

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Bulletin of the New York Mathematical Society, vol. ii. No. 2, November 1892.—This number practically consists of one paper, and that a very interesting one, by Dr. Emory McClintock, "On the Non-Euclidian Geometry," a subject which has been more than once brought before our readers. In vol. viii. (1873) appeared Clifford's translation of Riemann's Habilitationsschrift "ueber die Hypothesen welche der Geometrie zu Grunde liegen" (1854). In 1883 this geometry was considered in Cayley's British Association address, and quite recently (February 25, 1892) in a translation of Poincaré's "Revue Generale des Sciences." "The chief lesson to be obtained from all non-euclidian diversions is that the distinguishing mark of euclidian geometry is fixity of distance-measurement, by which alone it is possible to draw the same figure upon different scales. That the same figure may be drawn upon different scales might well be laid down as the axiom necessary and sufficient to distinguish euclidian from non-euclidian geometry." To this is appended a footnote which says that this is "referred to as 'the axiom of similars' by Sir *Richard* (sic) Ball in the article 'Measurement' of the "Encycl. Brit." A short article follows on the new logarithmic tables of J. de Mendizábal-Tamborrel (Paris, Hermann, 1891). In addition there are the usual "Notes," but no list of publications.

No. 3, December 1892.—This number contains a careful criticism of Ball's "Mathematical Recreations," with suggestions and discussions by Prof J. E. Oliver of Ithaca, New York, and an account of Dr. Julius Bauschinger's "Zweites Münchener Sternverzeichniss, enthaltend die mittleren Oerter von 18,200 Sternen für das Aequinoctium, 1880," by Prof. T. H. Safford. "Notes" and "New Publications" follow.

Wiedemann's Annalen der Physik und Chemie, No. 12.—On the temperature coefficient of the electrical resistance of mercury and on the mercury resistances of the Imperial Institution, by D. Kreichgauer and W. Jaeger. The coefficient was measured in the case of the copies of standard resistances already described. The formula obtained for the resistance w_t at temperature t by two independent methods was

$$w_t = w_0\ (1 + 0{\cdot}000875t + 0{\cdot}00000125t^2)$$

—Generation of electricity by friction of gases against metals, by K. Wesendonck.—On galvanic polarization at small electrodes, by F. Richarz.—Electric oscillations in wires, direct measurement of the moving wave, by Kr. Birkeland. The oscillations were produced in two copper wires running parallel to each other at a distance of 80cm. They were 30m. long, and ended in one direction in brass plates 40cm. square, facing two similar plates connected with the terminals of the spark gap of a powerful induction coil. The potentials along the wire when the coil was working were determined by measuring the length of the sparks crossing between the knobs of a spark micrometer, one of them being connected with the wire by a sliding contact, the other leading through a telephone to earth. Statical effects on the telephone were made inappreciable by laying a thread moistened with dilute sulphuric acid across the wires near the "collector" plates. Under these circumstances the passage of sparks was immediately indicated by the telephone, and their length could be measured down to 0·0005mm.—Determination of dielectric constants by means of the differential inductor, by Oscar Werner.—Measurement of resistances by means of the telephone, by Max Wien.—Diffusion of light by rough surfaces, by Christian Wiener. Experiments made on cast gypsum show that Lambert's law of diffusion, according to which the brightness of a surface is independent of the angle from which it is seen, is not strictly correct. The brightness at the edge of a round surface is 0·6 times that given by his law. In the vicinity of reflection points the brightness is greater, and at the greatest brightness the angle of incidence is greater than the angle of reflection.—A unit for measuring intensity of sensation, by the same.—On internal friction of solid bodies, especially metals, by W. Voigt.—Measurement of the coefficient of diffusion of liquids, by F. Niemoeller.—Absolute compressibility of mercury, by G. de Metz.—Propagation of energy through the ether, by G. Helm.—On the utilization and action of the telephone in electrical null methods; reply to Hr. Winkelmann, by E. Cohn.—On the solution of sodium silicates, and influence of time upon their constitution, by F. Kohlrausch.—Behaviour of polarized light in refraction, by G. Quincke.—On a mercury arc light, by L. Arons.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Meteorological Society, December 21.—C. Theodore Williams, President, in the chair.—The following papers were read:—Moving anticyclones in the Southern Hemisphere, by Mr. H. C. Russell, F.R.S., Government Astronomer, New South Wales. The author describes the results of his practical study of the daily weather charts for Australasia, and states that the leading fact brought out is that the weather south of 20° S. latitude is the product of a series of rapidly moving anticyclones, which follow one another with remarkable regularity, and are the great controlling force in determining local weather. These anticyclones are more numerous in summer than in winter, the average number for the year being 42. They usually take seven or eight days to travel across Australia in summer, and nine or ten days in winter; the average daily rate of translation being 400 miles. The shape of the anticyclone appears to undergo some modification as it nears the east coast. The winds on the north side of the anti-cyclone are not so strong as those on the south side, and the intensity of the weather is in proportion to the difference in pressure between the anti-cyclone and the V-depression, but the relation of the pressures varies frequently before the wind responds, the pressure appearing to be controlled from above by the more or less rapid descent of air which feeds the anticyclone. Cyclonic storms are very unusual, and do not occur more than once in two or three months.—The tracks of ocean wind systems in transit over Australasia, by Capt. M. W. C. Hepworth. The author has examined the daily weather charts of Australia and New Zealand, and has prepared maps showing the daily positions of the centres of high and low pressures for a whole year. He finds that the wind systems, which make their first appearance to the westward and south-westward, advance to the eastward rapidly, and frequently very rapidly, during the winter months, but during the summer months they usually move more slowly, and not unfrequently recurve. Their progress is retarded by contact with the areas of high pressure which they encounter; the mean of the tracks of these anticyclones, moving also from west to east, appears to be across the southern portion of Australia and onward, crossing the islands of New Zealand during the winter months, but to the southward of Western and South Australia, across Victoria and New South Wales, and thence to the north-eastward, avoiding New Zealand during the summer months.—Rainfall of Nottinghamshire, 1861–90, by Mr. H. Mellish. The author has collected and discussed all the rainfall records made in the county during the thirty years, and finds that in the extreme west the mean rainfall is 27 inches or more, and that over the rest of the county it varies between 25 and 27 inches, except north of the Manchester, Sheffield and Lincolnshire Railway, where the rainfall is less than 25 inches, and in the north east towards Gainsborough, where it is not more than 23 inches. The year of greatest rainfall was 1872, and of least rainfall 1887. October is the wettest month and February the driest.—A new instrument for cloud measurements, by Dr. Nils Ekholm.

Geological Society, December 21, 1892.—Prof. J. W. Judd, F.R.S., Vice-President, in the chair.—The following communications were read:—On a Sauropodous Dinosaurian vertebra from the Wealden of Hastings, by R. Lydekker. In addition to *Hoplosaurus armatus* and *Pelerosaurus Conybearei*, there is evidence of another large Sauropodous Dinosaur in the Wealden, now known as *Morosaurus brevis*. Up to the present time it has been impossible adequately to compare *Hoplosaurus armatus* with *Morosaurus brevis*; but recently Mr. Rufford has sent to the British Museum an imperfect dorsal vertebra of a large Sauropodous Dinosaur from the Wealden of Hastings, which enabled the required comparison to be made. The author describes the vertebra, contrasts it with that of *Hoplosaurus armatus*, and gives presumptive evidence that it should be referred to the so-called *Morosaurus Becklesi* (Marsh), which apparently cannot be separated from *M.* (*Cetiosaurus*) *brevis*. He has not been able to compare Mr. Rufford's specimen with the dorsals of the American *Morosaurus*, in order to discover whether the English Dinosaur is correctly referred to that genus. This paper led to a discussion, in which the chairman, Mr. Hulke, Prof. Seeley, Mr. E. T. Newton, and the author took part.—On some additional remains of Cestraciont and other fishes in the Green Gritty Marls, immediately overlying the Red Marls of the Upper Keuper in Warwickshire, by the Rev. P.

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